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ABSTRACT

This document provides guidelines for the preparation of school district plans for implementation of the microcomputer instructional programs recommended for Arkansas high schools. Introductory materials include a history and description of the Instructional Microcomputer Project for Arkansas Classrooms (IMPAC), results of a state-wide microcomputer survey, a statement of IMPAC's philosophy and goals, and recommendations to school administrators for providing leadership to their schools' microcomputer activities. Descriptions are then provided of six areas in which high schools have used microcomputers for instructional purposes: (1) computer-managed or computer-assisted instruction; (2) computer-assisted teaching; (3) computer education courses; (4) business education courses; (5) problem solving; and (6) information management. Recommendations are also provided for selection of software and hardware, space and furniture, and teacher inservice training. Appendices contain a school district planning guide, a list of software evaluation sources, and three different evaluation forms, suggestions for selecting a microcomputer and peripherals, equipment bid specifications and maintenance agreements, a list of members of the computer science course content guide committee, recommendations for classroom facilities (classrooms and laboratories) and electrical equipment, a list of institutions that provide computer courses which meet state guidelines, and outlines of three levels of state-recommended inservice courses for teachers and instructional coordinators. (JB)

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School District Planning

Grades 9-12

Computers in Education



IMPAC

Instructional Microcomputer

Project for

Arkansas Classrooms

Arkansas Department of Education

1985

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SCHOOL DISTRICT PLANNING

GRADES 9 - 12

COMPUTERS IN EDUCATION



Instructional Microcomputer
Project for
Arkansas Classrooms

Prepared by the
Arkansas Commission on Microcomputer Instruction
Department of Education
Little Rock, Arkansas 72201

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HISTORY AND DESCRIPTION OF IMPAC PROGRAMS

Act 528, enacted during the 1983 legislative session, established a nine-member commission to assist Arkansas schools in finding cost and educationally effective ways to utilize microcomputers in basic skills instruction in mathematics, reading and language arts. The Commission provides leadership in the development, implementation and evaluation of the Instructional Microcomputer Project for Arkansas Classrooms (IMPAC).

IMPAC has developed four types of programs in 22 Arkansas school districts involving 111 classroom teachers, grades 4-6. The four programs are Computer Managed Instruction-Computer Assisted Instruction (CMI-CAI), Computer Assisted Instruction (CAI), Microcomputer Basic Skills Laboratory and Computer-Assisted Instruction Management (C-AIM) which is a basic skills testing and prescriptive program. In addition to these pilot programs, the Commission has provided leadership in several other areas vital to long range goals. These activities include:

- A. The development of resource materials and guidelines for microcomputer instruction in Arkansas school districts for grades 3-8;
- B. Leadership conferences on in-service education related to microcomputer instruction;
- C. A writing conference directed by David Loertscher and David Carl from the University of Arkansas at Fayetteville to develop course outlines for three levels of in-service training;
- D. Assistance in establishing a summer institute to train consultants in the area of microcomputer instruction;
- E. An annual survey of school districts to maintain data on the status of program development and hardware acquisition;
- F. A feasibility study and development of comprehensive microcomputer reading, language arts and science courseware for general distribution to Arkansas school districts.
- G. Establishment of a method of selecting high quality courseware to be recommended for use by Arkansas school districts;
- H. The securing of grant donations of microcomputer systems from Apple, Commodore, IBM, Radio Shack and Sperry which provide the basis for a teacher in-service training center and software review lab at the Little Rock IMPAC office and State Department of Education regional education centers.

Recommended Courseware List

A recommended courseware list has been developed and made available to Arkansas schools for use in selecting courseware including mathematics, reading, language arts, social studies, science, business, computer science and computer programming. The third edition of the list will be mailed to all school districts in early fall 1985.

Results of Microcomputer Survey

The data below indicates that an additional 5,167 microcomputers were purchased by Arkansas school districts between October 1983 and December 1984.

Brand	Jan '83	Oct '83	%Total Oct 83	Dec '84	%Total Dec 84	Gain/ Loss
Commodore	881	2013	47.6	4058	43.2	-4.4%
Radio Shack	527	1357	32.1	2562	27.2	-4.9%
Apple	92	416	9.8	1465	15.6	+5.8%
Texas Instruments	59	257	6.1	616	6.6	+ .5%
Franklin	-0-	144	3.4	481	5.1	+1.7%
IBM	2	36	.8	181	1.9	+1.1%
Atari	-0-	2	0	13	.1	+ .1%
Other	8	13	.2	29	.3	+ .1%
	1529	4238	100.0	9405	100.0	

Student/Computer ratio
in Arkansas Public

Schools: 275/1 102/1 46/1

IMPAC ASSISTANCE TO HIGH SCHOOLS

The new standards for accreditation in Arkansas public schools require that a computer science course be offered every two years beginning in 1987. Therefore, IMPAC is expanding its assistance to Arkansas high schools. The IMPAC staff's highest priority is working with the IMPAC project schools and project teachers. Now, however, the staff will provide guidance, resource materials, workshops, regional conferences and on-site visitations to high schools, when possible.

PHILOSOPHY

Our age is one of rapid scientific and technological change. All students must be prepared to use computers on at least some level in order to function effectively in a society that is becoming more dependent on computer and communications technology. IMPAC recognizes the need for computer education to be integrated into the school curriculum as a tool for instruction, problem solving and as an aide to efficiently storing, retrieving and processing data for decision making.

Computer education involves three main aspects - awareness, problem solving, and applications. Computer awareness can be taught at any grade level in curriculum areas where students are provided the opportunity for computer assisted instruction. While problem solving skills can be learned throughout a student's education, in recent years basic skills instruction has taken priority in the elementary school. This has placed a greater responsibility with the secondary schools for providing the students with an arena for developing analytical thought. The computer, with its capability for simulation and interactivity, could prove to be a valuable tool for achieving this goal. Programming and application principles deserve a place in the high school curriculum as a part of traditional offerings as well as courses especially designed to accomodate the new computer science discipline.

Computer education can expand the learning opportunities for all students regardless of their socio-economic status, gender, ethnic background or level of academic achievement. Care should be taken by educators to insure that computers are integrated as learning tools throughout the curriculum and that extensive hands-on computer experience is provided for all students. It is imperative, however, that balance is retained in the curriculum. Basic communications and problem solving skills remain a priority and computer skills should enhance and not detract from their importance.

GOALS

Computer education in grades 9-12 should prepare all students to:

- A. Understand and use computer terminology when discussing this form of technology,
- B. Have a good understanding of the capabilities and limitations of the computer,

- C. Interact with a computer using a variety of commands and software for CAI or problem solving,
- D. Apply knowledge gained about computers to the pursuit of career goals and
- E. Value ethics and legal responsibilities concerning the computer.

Schools should also allow all students the opportunity to advance their computer education through experiences in: programming, hardware and software utilization and applications of a computer system in simulating or solving practical problems.

SCHOOL DISTRICT PLANNING

A school district's microcomputer utilization plan should be developed as a part of the district's six year plan. The school administration should provide leadership in implementing the following activities:

- A. Establish a Committee on Microcomputer Instruction, under the leadership of a coordinator, to study the IMPAC approved programs and guidelines and make recommendations to the appropriate school officials. The Committee should include representation from the teachers and administrative staff in grades 9-12. Representation from local business or industry, the community and the school board is also recommended.
- B. Charge the committee with securing a description of the instructional programs now in operation at all grade levels including business education, programming, literacy, special education and basic skills. The funding sources such as Vocational, Chapter 1, Chapter 2, Special Education, Business and Industry and local funds should be specified. See Appendix A for an outline that may be followed by your local Committee on Microcomputer Instruction in clearly defining each program.
- C. Identify IMPAC recommended programs and develop a plan for implementation. The guidelines provided in this document should be followed and evidence given that the district can implement the program successfully. IMPAC research in Arkansas and outside the state has provided a basis for the present guidelines.

The type of microcomputer instructional program the district seeks to implement will determine the in-service education required, the hardware, software and maintenance needs, as well as the funds that must be allocated.

COMPUTERS IN HIGH SCHOOL EDUCATION

Schools have used microcomputers for instructional purposes in six different areas - CMI (and/or) CAI and CAT programs, computer education and business education courses, problem solving and information management in existing curriculum areas. Brief descriptions of these programs are given below. Refer to specific program type in this publication for a more detailed discussion.

CMI (and/or) -CAI Programs

Computer Managed Instruction uses the computer to manage instruction in the educational setting by planning, preparing, monitoring, and analyzing instruction and student performance. For example, a student can take a test and the computer will score the test and diagnose areas of weakness. The teacher can then use this information in making an appropriate assignment for the student. This can then be recorded in the student's record file on the computer. Reports to parents and lesson plans for teachers may also be generated.

Computer Assisted Instruction is a computer program that uses linear and branch programming techniques and incorporates principles of behavioral psychology. The instructional tasks a computer can do include drill and practice, remediation and enrichment activities.

CAT

Computer Assisted Teaching, a relatively new concept in education, uses the computer in the classroom in the same way any other audio-visual media has been employed. By taking advantage of the computer's ability to provide graphics, sound and branching the computer could provide a better teaching aide than the overhead and slide projector or even the chalkboard.

Computer Education Courses

Computer education courses in the high school should include the state required computer science course, computer programming and advanced programming. The computer science course should cover such topics as fundamental skills, role of technology in our society, application of computers to problem solving and introduction to programming. A computer programming course should stress structured programming techniques, computer logic and problem solving with computers. An advanced computer programming course should teach programming in a language other than BASIC -- Pascal or COBOL are recommended. At this writing, the Advanced Placement Computer Science Test will require the use of Pascal. Any advanced programming course should have as its major emphasis programming methodology, algorithms, and data structures.

Business Education Courses

For students to have a functional business education background as well as any marketable skills, the computer will have to become the focal point of the business education curriculum. Every business course could utilize the

computer in some capacity. The computer applications and concepts taught in the business education area are word processing, automated accounting, computer keyboarding, data base management and electronic spreadsheet applications.

Problem Solving

While the basic skills of reading, writing and arithmetic provide the foundation, the educational experiences should include extensive problem solving activities on different levels and in different curriculum areas. The computer can be programmed to present to the student problems in science, mathematics and social studies, lead the student through good problem solving strategies, and then ask the student to make a decision. The computer can then help the student evaluate the ramifications of his decision. By taking the student through a step-by-step approach to problem solving, the computer provides an excellent tool for helping develop analytical thought processes.

Information Management

Using the computer for information management can serve the classroom in much the same way it has served industry for years. By taking advantage of spreadsheets, data bases and word processors students can learn to input, store and report data in an organized and efficient manner.

COMPUTER ASSISTED INSTRUCTION - COMPUTER MANAGED INSTRUCTION

Any decision about the use of computers as an instructional tool should take into account the following considerations:

- A. Is there sufficient software available for the curriculum and purpose intended?
- B. Is there adequate time and resources for staff training?
- C. Is there a commitment for continuous evaluation of the program to ensure it meets current instructional needs?
- D. Is there ample class time available for the integration of computer instruction into the existing curriculum?

Applications in the Existing Curriculum

Drill and Practice:

This method of instruction uses the computer to reinforce a concept already taught by the teacher. Students could review a list of vocabulary words, practice spelling skills or work math problems. This mode of instruction enables the student to work on an individualized speed and difficulty level, as well as providing an additional method by which concepts and skills can be reinforced. Any benefits derived from this type of instruction will necessarily be based on the quality of the software and the capabilities of the computer. Immediate feedback as to accuracy of student response is critical to the effectiveness of this type of instruction. Management included in the software could provide the teacher with a valuable tool to monitor students' mastery of concepts and identify areas of difficulty.

Tutorial:

Tutorial programs introduce and explain a concept and then question the student to evaluate student understanding. A high level of student involvement is important in this type of program. Based upon the accuracy of student responses the program will branch to additional explanations of the concept or to a new concept.

As with drill and practice, management on the tutorial program could be a very useful tool to the teacher in assessing student mastery. Tutorial programs are an effective means of teaching when instructional needs go beyond the scope of the text or when the students in the class are at different instructional levels.

Course Remediation and Enrichment:

Any one or combination of the program types mentioned above could provide the school with the resources for course remediation and/or enrichment. The

computer provides the necessary motivation and individualized approach that makes remediation and/or enrichment more effective. With good management included in the software, the program could prescribe a particular course plan for the student, ensure that concepts are mastered before allowing the student to advance and provide reports to the teacher of any student difficulties. With good software and adequate computer time, slow students could receive additional help with course difficulties and brighter students could be challenged beyond the scope of the regular course objectives.

In choosing software for the above programs thought should be given to whether single-concept or a comprehensive software package will best fit the student's needs. If a student's access to the computer is less than three times a week and the teacher wants to control the concepts presented to each individual student and the mastery level required, single concept software is a practical option. On the other hand, if a teacher wants to establish a computer managed instructional program, a comprehensive software package would better suit the teacher's needs. Management on educational software refers to the computer making assignments, testing for mastery and reporting results to the instructor. Typically, comprehensive software packages contain more management features than do single-concept software.

Regardless of the type of software desired, preview before purchase can eliminate needless expenditures and purchases that do not adequately meet the needs of the student. For more information on software purchases see "Selection of Software" in this publication.

Computer-Assisted Teaching

Using the computer as an audio-visual aide can provide more depth to the lecture or demonstration than other media. When connected to a large monitor the computer can illustrate concepts or simulate events that would be difficult, dangerous or expensive to do in other ways. Science teachers with the aide of computer software can simulate blood flow through a heart given a certain pulse rate; show the anatomy of a frog's muscles and tendons and highlight ligaments in different colors; or demonstrate the change in sound waves given different parameters. Social studies teachers can use a computer to demonstrate routes taken by explorers, show demographic features of states or tap data bases using a modem. The computer's ability to change screens based on keyboard input provides the teacher with more flexibility than a slide or overhead projector.

By becoming familiar with other languages such as PILOT or LOGO, teachers can write their own screens and take advantage of the computer's capability for sound, motion and interactivity. These teacher-written programs could then be incorporated with commercial software in creating an exciting audio-visual teaching aide.

COMPUTER EDUCATION COURSES

Keyboarding

Good keyboarding skills are necessary for any computer course. Students with a w.p.m. rate below 35 may have difficulty inputting and editing their data during their allotted computer time. Schools should seriously consider requiring a keyboarding or typing course as a prerequisite to the computer education curriculum.

Computer Science Elective

On February 22, 1984, the State Board of Education adopted as one of its Standards for Accreditation of Arkansas Public Schools that each high school in Arkansas must offer a Computer Science course at least every two years. This requirement will become effective June 1, 1987. See Appendix E for members of the computer science committee responsible for the following guidelines and course content adopted for this course.

The purpose of the computer science elective is to introduce students to the four major interrelated units of study: Fundamentals, Applications, Programming and Logic, and Ethical and Social Implications. Two of the desirable outcomes of the course are learning about a computer and its use as a tool for problem solving. For this reason, the recommended programming philosophy in this computer science course reflects the general systems approach or scientific method. It is suggested that the instructor avoid an approach where programming statements are used in isolation; rather, the instructor should guide the students through programming using the following approach. Program development should follow this procedure:

1. Define the problem
2. Plan and design strategies to solve the problem
3. Write structured code
4. Test and evaluate results
5. Refine solutions
6. Write documentation

The relationship among the four major units in this full year course suggest that Fundamental Concepts must precede the other three units. The interrelationship between Applications and Programming and Logic should be recognized and reflected in the teacher's approach to the course. Ethical and Social Issues can effectively be treated throughout the course when skill levels in the other units provide a sufficient basis for understanding the issues.

The number of computers available for use in the course is a question that should be addressed only after the school selects the software and brand of computer that will be used to accomplish all of the basic skill objectives and most of the developmental and extension skills. If one assumes a maximum of 30 students in a course, a minimum of one computer per ten students is recommended. Therefore, schools with average enrollments of ten or fewer,

11-20, 21-30 students should make available one, two or three computers respectively. A minimum of one disk drive and printer should be available.

Keyboarding and algebra skills, as each is traditionally taught by business education and mathematics teachers, may become very valuable for students using computers in other courses. This is especially true for students who use word processing as a writing tool for manuscript preparation and editing or students keying in programs that are required as a part of assignments in upper level courses. If all students are expected to do either of these during or in the school year following the completion of the computer science course, then the school should consider requiring the unit of introductory typing and Algebra I as a prerequisite for the computer science course. A policy on this matter is important prior to the formal offering of the course as an elective.

I. Fundamental Concepts

A. Characteristics of a computer.

BASIC SKILLS

1. Distinguish among the various types of computer systems.
2. Identify the components of a computer system (input, process control, storage, output).
3. Identify appropriate input, output and storage devices for each type of computer.
4. Trace the flow of information through the components of a computer system.
5. Discuss the binary number system as it relates to the operations performed by a computer.
6. Identify and discuss the function of other computer related equipment such as modems and card readers.
7. Name and discriminate among programming languages such as business, scientific/numeric, structured programming and authoring.

B. Operations

BASIC SKILLS

1. Demonstrate familiarity with location of letters, numbers and special function keys on the keyboard.
2. Demonstrate proper handling and care of equipment.
3. Perform appropriate start-up procedures.
4. Perform system commands necessary to store and retrieve a program and obtain a directory or catalog.

II. Programming and Logic

A. Programming Readiness Skills.

BASIC SKILLS

1. Read and interpret flow charts.
2. Read a program and describe the output.
3. Execute a given program.
4. Demonstrate appropriate editing techniques.
5. Modify a program to alter the output.

B. Programming

BASIC SKILLS

1. Outline steps in problem solving using programming:
 - a. Define the problem.
 - b. Plan and design strategies to solve the problem.
 - c. Write structured code.
 - d. Test and evaluate solutions.
 - e. Refine solutions.
 - f. Write documentation.
2. Write programs to solve a given problem.
 - a. Use the identified steps.
 - b. Demonstrate the following programming techniques:
 - Input/Output statements
 - Calculations
 - Variable handling
 - Internal documentation
 - Conditional statements
 - Graphic statements
 - Looping

DEVELOPMENTAL SKILLS

Extend the programming skills to include:

- a. Screen formatting.
- b. Random number generation.
- c. String handling techniques.
- d. Subroutines.
- e. Arrays.
- f. Printer formatting.
- g. Animation graphics.
- h. Sequential file handling.
- i. Logical operators.

EXTENSIONS

Further extend the programming skills to include:

- a. Simulation graphics.
- b. Iterations.
- c. Monte Carlo techniques.
- d. Random file handling.

- e. Information interchange codes.
- f. Demonstrate comparable skills in a second language.

III. Impact on Society

A. History and Development.

BASIC SKILLS

1. Trace the evolution of computing devices through the manual, mechanical and electronic stages identifying significant contributors and their inventions.
2. Trace the development of the electronic computer through the four generations.
3. Identify technological advances which may characterize future generations of computers.

B. Implications of technology for individuals in society.

BASIC SKILLS

1. Describe how electronic computer technology has influenced the following areas:

Business and finance	Communications
Manufacturing	Transportation
Medicine	Leisure and recreation
Military	Management of resources
Government	Opportunities for the handicapped
2. Describe career opportunities involving computers in the following areas:

Banking and finance	Military
Manufacturing	Conventional business
Medicine	Computer science

DEVELOPMENTAL SKILLS

Describe innovative problem solving techniques which have resulted from computer and communications technology such as:

- a. Rapid processing of information.
- b. Rapid transfer of information.
- c. Satellite technology.
- d. Simulations.
- e. Library retrieval services.

C. Ethics/Privacy

BASIC SKILLS

1. Discuss the issues of security related to computer hardware, software and data.

2. Discuss the issues of individual rights related to accessing and manipulating automated information, software development, and the use of purchased software.

DEVELOPMENTAL SKILLS

Define the meaning of each of the following as they pertain to software:

- a. Public domain.
- b. Copy protected.
- c. Licensing agreements.
- d. Copyright.
- e. Ownership.
- f. Rights to sell.

IV. Applications

The following applications are identified as ones that students should experience as a part of a comprehensive computer science course.

A. Graphics.

BASIC SKILLS

1. Sketch a picture on coordinate paper and write code to generate the graphic for output on the monitor or printer.

DEVELOPMENTAL SKILLS

1. Design and code a bar graph to illustrate data in pictorial form.
2. Create a graphic using a graphics tablet.

EXTENSION SKILLS

1. After creating a graphic with a graphic tablet incorporate the graphic as a part of a BASIC program.

B. Word Processing.

BASIC SKILLS

1. Key in a one-page document using a word processing package.
2. Load a prewritten word processing program.
3. Save a document on a diskette.
4. Print a document.
5. Edit a document using insert/delete and block move functions.
6. Clear the computer memory and prepare it for additional documents.

EXTENSION SKILLS

1. Demonstrate special functions of the word processing package and the spelling program.

C. Spreadsheet.

BASIC SKILLS

None

DEVELOPMENTAL SKILLS

1. Identify uses of a spreadsheet program.
2. Manipulate data for a simple application (home budget).

EXTENSION SKILLS

1. Design and use a spreadsheet program for hypothesis testing.

D. Data Base.

BASIC SKILLS

1. Identify uses of data base programs.
2. Manipulate a file using a data base package.

DEVELOPMENTAL SKILLS

1. Design and produce data using a commercial package.
2. Search and edit data entered by a student.

EXTENSION SKILLS

1. Explore an integrated software package that includes word processing, data base and spreadsheet options.

E. Instruction by Computer.

BASIC SKILLS

1. Use a CAI or CMI lesson to learn a concept.
2. Run a simulation program.

DEVELOPMENTAL SKILLS

1. Design and code a simple program to teach a concept.
2. Design and code a simulation or modeling program to solve a specified problem.

EXTENSION SKILLS

1. Design and code a lesson that may be used by other students to learn one or more concepts.
2. Design and code a complex simulation or modeling program to solve a specific problem.

F. Music and Voice Synthesis.

BASIC SKILLS

None

DEVELOPMENTAL SKILLS

1. Listen to a program that demonstrates computer generated music or voice then discuss the capabilities and limitations of this medium.

EXTENSION SKILLS

1. Write a simple tune using code or a prepared music software program.
2. Incorporate a tune into a coded program.
3. Demonstrate the use of voice synthesis software.

G. Electronic Communications.

BASIC SKILLS

None

DEVELOPMENTAL SKILLS

1. Identify the basic concepts of electronic (computer) communications.
2. Send data to another computer via a modem.

EXTENSION SKILLS

1. Complete an on line search for data by accessing a regional or national data base.

H. Robotics.

BASIC SKILLS

None

DEVELOPMENTAL SKILLS

1. Discuss the common function of robots to include locomotion, manipulation, visual recognition, and speech synthesis or sound recognition.

EXTENSION SKILLS

1. Program a robot to do as many of the following functions as possible locomotion, manipulation, visual recognition, speech synthesis and sound recognition.

I. Games.

BASIC SKILLS

1. Load and run several types of games including adventure, arcade or strategy.

DEVELOPMENTAL SKILLS

1. Design and code a simple adventure game that includes documentation.

EXTENSION SKILLS

1. Design and code an advanced game which may be of the adventure, arcade or strategy type.

Computer Programming I

A computer programming course should be designed for those students who are interested in pursuing programming for their own personal use or as a career opportunity. This course should not be aimed at those students wishing to become "computer literate". For this reason, it is recommended that the Computer Science elective be a prerequisite to this course as well as Keyboarding and Algebra I.

Structured programming techniques, proper program documentation and logical problem solving skills should be emphasized throughout the course. Programs designed and written by students should have practical applications. It is recommended that the maximum student/computer ratio should be 3 to 1 and a minimum computer access time of 90 minutes per week per student.

At this writing, most high school programming classes use the BASIC programming language, but COBOL and Pascal also deserve consideration as both lend themselves to proper programming techniques and practical applications. Fortran, while being a powerful mathematical and scientific language, has limited capabilities for the non-scientific student.

Below is a course content outline that could serve as a guide in developing a Computer Programming I course:

- I. Introduction to Structured Programming
 - a. Defining the problem
 - b. Designing the program

- c. Coding the program
- d. Testing and debugging the program
- e. Documenting the program

II. Introduction to Computer Programming

- a. System and utility commands
- b. Input/Output commands
- c. Variable names, types and usage
- d. Arithmetic statements
- e. Flow of control commands
- f. Flowcharting
- g. Formatting output

III. Concepts of Structured Design Theory

- a. Reasons for program maintenance
- b. Ease of program maintenance
- c. Loops without go/to statements
- d. Value of walkthroughs (trace tables)
- e. Design of control structures
 - 1. Top/down
 - 2. Modular

IV. Techniques of Advanced Programming

- a. Functions
 - 1. Mathematical
 - 2. User written
- b. Arrays
 - 1. For/Next
 - 2. Subscripted variables
 - 3. Table handling
- c. File handling
 - 1. Sequential
 - 2. Random Access
- d. Algorithms
 - 1. File manipulation
 - 2. Sorts
 - 3. Searches
- e. Graphics

Advanced Computer Programming Courses

Secondary schools have traditionally taken different approaches to Advanced Computer courses. Some have seen advanced courses as an opportunity for students to learn a second language such as COBOL, Fortran or Pascal. If this is the philosophy followed, it is recommended that the level of problem solving be more advanced than what is required in the Programming I course. Students should use their programming skills to solve statistical, file and data management problems as well as the writing of simulations. Data structures should be thoroughly investigated, and students should have a good

understanding of system components and configuration. Telecommunications should be investigated and some discussion of the student's social and ethical responsibilities as computer users should also take place. A part of this course could also be an introduction to Assembly Language programming and linking of a student's programs with algorithms written in Assembly.

Another option secondary schools have for an upper level programming class is to offer an Advanced Placement Computer Science Course. The Arkansas Standards for Accreditation state, "each high school shall investigate and, where feasible, provide advanced placement opportunities." Advanced placement courses offer the high school student the opportunity to complete college level studies in their secondary schools. High Schools that have faculty with the necessary expertise and access to computing facilities should consider this course offering. Questions concerning advanced placement should be directed to: College Board Southwest Regional Office, Suite 922, 211 East 7th Street, Austin, Texas 78701, phone (512) 472-0231.

BUSINESS EDUCATION

Arkansas Vocational Education Department, Business Education Section, has developed the following course descriptions, recommendations and requirements for computer use in vocationally funded business education courses. For further information, contact Tommie Butler, Supervisor, Business Education, Vocational Education Department, (501) 371-1768.

COMPUTER TECHNOLOGY OPTIONS

Because of the tremendous technological advancements taking place in modern business, a continuous updating of the Business Education curricula is mandatory. Options have been developed to give the comprehensive high schools and vocational centers the flexibility needed to adjust to current technology, the students' changing interests and labor market needs. It is recommended that keyboarding skills be a prerequisite to enrollment in computer technology courses.

Business Education courses in computer technology have been structured so that programs may be articulated among comprehensive high schools, vocational centers, and postsecondary institutions. This structuring includes three levels of training:

LEVEL ONE includes introductory course offerings in Computer Technology: Introduction, Accounting I, and Word Processing I.

LEVEL TWO includes course offerings Computer Technology: Information Systems, Accounting II, Word Processing II, Database Concepts, Electronic Records Management, Programming, and Spreadsheet and Analysis:

LEVEL THREE includes advanced training involving courses in LEVEL ONE and TWO, as well as other computer-based instruction. In most instances, this level is provided in postsecondary institutions.

Comprehensive High Schools - Curriculum designers are encouraged to develop courses in LEVEL ONE and TWO for students pursuing business careers.

Vocational Centers: Curriculum designers are encouraged to develop courses from LEVEL TWO. These courses require some previous computer training and should be selected after a careful study has been made of the computer technology courses available in the surrounding comprehensive high schools. One of the criteria for program approval in the vocational centers will be no duplication.

In this first issue of the Business Education Course Content Guides, the following courses are included as computer technology options:

- Computer Technology: Accounting I
- Computer Technology: Accounting II
- Computer Technology: Introduction
- Computer Technology: Information Systems

Computer Technology: Word Processing I
Computer Technology: Word Processing II

Course content guides to be developed are:

Computer Technology: Database Concepts
Computer Technology: Electronic Records Management
Computer Technology: Spreadsheet and Analysis
Computer Technology: Programming
Advanced BASIC
Pascal
COBOL (Introduction)
RPG II

EXPLORATORY BUSINESS

Grade level: 9, 10

Prerequisites: None

Number of Computers Recommended: One for every four students

Minimum Computer Memory: 128K required for new purchases

Exploratory Business is a one-year course designed to provide opportunities for students to investigate broad occupational categories in the field of business. Exploratory activities will be provided in the following areas: Computer literacy, keyboarding, management and finance, accounting, data/word processing, marketing, secretarial and clerical. Exploratory Business is NOT a skill-development course, but rather is designed to help students "explore" the various occupational areas of business and to aid them in identifying their interests and aptitudes in these areas.

COMPUTER TECHNOLOGY: WORD PROCESSING I

Grade level: 10,11,12

Prerequisites: Typewriting I

Number of Computers Recommended: One for every two students

Minimum Computer Memory: 256K

Computer Technology: Word Processing I is a one-semester course designed to provide students with entry level skills in word processing concepts, operations, text manipulations, and production of business documents using an intermediate or advanced level software program. In addition, training in basic word vocabulary skills; mechanics of punctuation and grammar; format and style; and proofreading, editing, and reviewing business documents is included in the course.

COMPUTER TECHNOLOGY: INTRODUCTION

Grade level: 10,11,12

Prerequisites: Keyboarding skills

Number of Computers Recommended: One for every two students

Minimum Computer Memory: 256K

Computer Technology: Introduction is a one-year course designed to prepare students with an introduction to computers and business applications which are necessary to live and work in a technological society. Emphasis is given to data entry, computer concepts and operations, programming and design, computer software, implications of technology in society, and ethics. The course is designed to provide students with an understanding of the business, industrial, and scientific areas in which the computer is used.

TYPEWRITING I

Grade level: 9,10,11,12

Prerequisites: none

Number of Computers Recommended: One for every two students

Minimum Computer Memory: 256K

Typewriting I is a one-year course designed to introduce the student to typewriting with emphasis on desirable typewriting techniques. Emphasis is placed on the following: mastery of the keyboard; development of speed and accuracy; basic problem-solving applications of centering and arranging reports, letters, and tables; proofreading; and the care of the typewriter. Typewriting I is a requisite for entry-level skills in business careers.

TYPEWRITING II

Grade Level: 9,10,11,12

Prerequisites: Typewriting I

Number of Computers Recommended: One for every two students

Minimum Computer Memory: 256K

Typewriting II is a one-year course designed to continue speed and accuracy development to improve production of various types of business communications and reports, to supplement knowledge of typing special business forms and tables, and to refine efficient work habits. Instruction in reprographics may be included which provides specific instruction in typestyles, supplies, copy preparation, and duplication processes. Typewriting II provides the skills and knowledge necessary for entry-level employment in office positions.

OFFICE TECHNOLOGY LABORATORY

Grade Level: 11, 12

Prerequisites: Typewriting I

Number of Computers Recommended: One for every two students

Minimum Computer Memory: 256K

Office Technology Laboratory is a one-year, two period block course designed to provide opportunities for students to develop advanced office skills. The instruction is individualized according to the student's occupational objectives, abilities and background. Presimulation units should include business careers, business mathematics, business communications, human relations, introduction to data processing, job preparation and application, business machines, and records management. Word Processing instruction is an important component of this course. A flow-of-work simulation is required as a culminating experience for this course.

OFFICE PROCEDURES

Grade Level: 11, 12

Prerequisites: Typewriting I

Number of Computers Recommended: One for every two students

Minimum Computer Memory: 256K

Office Procedures is a two-semester course designed to acquaint students with the procedures and skills necessary for the operation of a modern office. The units of instruction include office careers, human relations, records management, word/data processing, reprographics, communications, preparation of mailable letters/reports, and mail and shipping services, telephone techniques, research, banking and legal procedures, payroll and taxes, travel and conferences, and professional placement and advancement.

JUNIOR EXECUTIVE TRAINING

Grade Level: 11, 12

Prerequisites: Accounting I (Recommended)

Number of Computers Recommended: One for every two students

Minimum Computer Memory: 256K

Junior Executive Training (JET) is a two-hour block course designed to focus on small business ownership and the managerial process. It examines the functions of planning, organizing, staffing, directing and controlling a business. Accounting applications as they pertain to the functions of the small business are included. Leadership development, positive self-image, and attitudinal training are necessary components of the curriculum. In addition, data processing concepts and computer training should be included. The Executive Games, with emphasis on managerial decision-making are considered an integral part of Junior Executive Training.

COMPUTER TECHNOLOGY: WORD PROCESSING II

Grade Level: 11, 12

Prerequisites: Word Processing I

Number of Computers Recommended: One for every two students

Minimum Computer Memory: 256K

Computer Technology: Word Processing II is a one-semester course designed to provide students with competencies in word processing concepts. Emphasis is on productions of business documents and application including formats creating and maintaining files, repetitive documents, revising and printing.

COMPUTER TECHNOLOGY: INFORMATION SYSTEMS

Grade Level: 11, 12

Prerequisites: Computer Technology Introduction

Number of Computers Recommended: One for every two students

Minimum Computer Memory: 256K

Computer Technology: Information Systems is designed to emphasize information processing, applications and systems concepts as well as a continuation of

computer fundamentals. The context of the course emphasizes that computer programming is a step-by-step process and that there is more to computer programming than the simple writing of code in a programming language. Students will be exposed to and given an opportunity to master proven tools for program development, including preparation of structure charts, writing pseudocode, and sets of structured English statements that describe the steps used to implement solutions to information processing problems on computers.

COMPUTER TECHNOLOGY: ACCOUNTING I

Grade Level: 11, 12

Prerequisites: None

Number of Computers Recommended: One for every two students

Minimum Computer Memory: 256K

Computer Technology: Accounting I is a one-year course with emphasis on basic accounting principles as they relate to both manual and computerized financial systems. Instruction is on an integrated basis using computers and electronic calculators as the relationships and processes of manual and computerized accounting are presented. A knowledge of programming is not necessary for enrollment. Entry-level skills in the accounting occupations can be attained.

COMPUTER TECHNOLOGY: ACCOUNTING II

Grade Level: 11, 12

Prerequisites: Accounting I or Computer Technology: Accounting I

Number of Computers Recommended: One for every two students

Minimum Computer Memory: 256K

Computer Technology: Accounting II is a one-year course designed to provide students with the knowledge, understanding and skills necessary for successful careers in accounting. Partnerships, as well as departmental, corporate and cost accounting systems are components of the course. Emphasis is given to the computerized/automated functions in accounting.

PROBLEM SOLVING WITH COMPUTERS

The ways in which the computer can be used in helping students gain problem solving skills is limited only by the number of ideas of the educator.

Simulations

These types of programs use the computer to realistically represent real-life situations. Using the computer in this way could be extremely helpful when the real-life situation is too expensive or dangerous to be experienced in other ways. Students use their problem solving skills to make predictions and decisions given a set of parameters about an event.

There are very good software packages that are currently available in a broad range of curriculum areas that encourage analytical thought in students. The examples discussed below by no means constitutes an inclusive list of vendors or software, but should serve as only examples of what is currently available on the software market.

Social Science:

Minnesota Educational Curriculum Consortium (MECC), Compuware Inc. and Conduit, Inc. have developed simulations that allow students to explore and predict strategies for solving the world's energy problems. Lincoln's Decisions by Educational Activities leads students through key events in Lincoln's administration. Students are then presented with the same choices Lincoln faced and are challenged to duplicate his decision. Focus Media's Nationalism: Past and Present encourages students to role play given different philosophical positions while also teaching them map skills and graphing and interpreting case studies. Krell Software Corp, MECC, and Strategic Simulations have available simulations that allow students to predict the outcome of presidential elections given the political climate and platform of the candidates.

Science:

MECC's Earthquake and Earthware Computer Services' Volcanoes guide students through calculations and investigations necessary to predict these geological events. Holt, Rinehart and Winston, COMPRESS, and Conduit have packages that simulate evolution and environmental conditions necessary for survival. Educational Technology's Space Lab provides a simulated laboratory for measuring properties of mysterious crystals obtained during missions in outer space. Circular Motion by Cross Educational Software discusses the problem-solving methods for circular and harmonic motion. Educational Activities' Heart Lab uses animated graphics to produce a simulation model of a functioning human heart, allowing students to view the heart's pumping action and trace the blood flow through the arteries, veins, and chambers. Scholastic has produced a biology software package entitled Operation: Frog that requires students to use logical analysis and synthesis in dissecting and reconstructing the frog.

Mathematics:

MECC, Sunburst Communications and Educational Activities have software that requires students to make decisions in simulated real-life activities involving math and business, such as balancing a check book, buying a home, comparison shopping and managing money. Graphics for Probability by Mathe Graphics and Discrete Probability by COMPRESS simulate concepts from probability and given parameter values, the program asks students to compute various distributions.

Business:

Southwestern Publishing Company and Gregg-McGraw Hill have several business simulations in accounting, typing and office practice that give students the opportunity to work with realistic business situations.

Data Collections and Inference

The computer can be used to store, categorize and graphically represent data from experiments in business, social science, and science. Students then have the information necessary and in the necessary form to make assumptions or inferences about the issue in question.

The microcomputer also has the capability to be inexpensively interfaced with scientific apparatus such as PH meters, thermistors, or timing devices. Students can conduct experiments on rapid temperature changes, variation of light intensity with distance, resonance, and spectral analysis of sounds or determine the periods of oscillating objects.

Using the computer for collecting, managing and recording information gives the student the real-life data that time would not permit collecting manually. There are numerous software and scientific suppliers that have the necessary hardware and software for these types of computer activities.

Calculations

Students without any programming skills can quickly and easily turn the computer into a calculator. This can aide in solving mathematical and scientific problems when lengthy calculations are needed. These are also easy-to-use graph plotter packages available that allow students to quickly show relationships between variables or plot the "best fit" line.

INFORMATION MANAGEMENT

The use of word processors, spreadsheets and data bases are proving to be as an effective management tool in the classroom as they have been in industry. Social Science and English classes are using word processing packages for papers written by students. The ease with which corrections, insertions and deletions can be made eliminate time-consuming rewrites. Students have more time for content analysis.

An industry level word processor is probably not needed for student paper writing. These packages are difficult to use and are more powerful than what is needed in theme writing. Examples of lower level word processing packages for English and social science classes are Easy Writer, Bank Street Writer, Scripts, and Omniwriter.

The use of spreadsheets and data bases can be very useful in any class or curriculum area that keeps records, budgets or other data items. Journalism departments can use spreadsheets and data bases to keep track of their budgets, advertising and subscriptions. Social science classes can use data bases to record information concerning important historical events. Mathematics classes are using spreadsheets to show relationships between statistical data and parameters. EasyCalc, VisiCalc, and Perfect Calc are fairly easy spreadsheet packages and Data Management and PFS File — data base packages.

RECOMMENDATIONS FOR SELECTION OF SOFTWARE

Choosing appropriate software is probably the single most important decision to be made. The optimum method of selecting software is to preview the program before purchase. Some software publishers and retail computer stores have an educational preview policy. Project IMPAC has a limited educational software library and a preview lab that is open to all teachers in Arkansas. Other schools or institutions that have a compatible curriculum are a resource for preview and recommendations.

In previewing the software, the following questions need to be addressed:

Does the educational content of the software fit the grade level intended?

- Is the content accurate and free of errors?
- Is the documentation clear and detailed?
- Are instructional guidelines included in the documentation?
- Does the program serve the purpose for which it was intended?
- Are the program instructions clear?
- If the software has management, does it diagnose student's abilities, prescribe an appropriate level of instruction and monitor student performance?
- Does the program provide motivation by good use of graphics?
- Is there sufficient interactivity by providing immediate feedback?
- Does the program randomize problems and examples?
- Is adequate practice given to the student?
- Do educational games stress instructional values rather than game format?

When preview is not possible, it is recommended that software evaluation sources be consulted before purchase. See Appendix B for a listing of these sources and three software evaluation forms that may be duplicated and used by software evaluators. Project IMPAC also publishes a Recommended Courseware list which is available to all schools.

RECOMMENDATIONS FOR SELECTION OF HARDWARE

Hardware refers to the microcomputer itself and the equipment needed to make it operable. In general, for schools a microcomputer system with a minimum of 128K RAM memory, a monitor and a disk drive is recommended. The keyboard should be similar to that on a typewriter. Management, word processing, business education and advanced applications software may require up to 256K; therefore, expandability of memory is becoming increasingly important. The application will determine whether a printer is necessary.

If eight or more microcomputers are to be purchased, networking might be considered. That has been done successfully in numerous schools and with a hard disk, memory capacity and speed of accessibility can be increased. Networking also allows for the sharing of programs and peripherals among several computers. For courses requiring heavy use of a printer and the computers are not networked, a black box switch can be used to link three or four computers to one printer.

In purchasing hardware devices it is also recommended that the number of different vendors be kept to a minimum. This encourages vendor accountability for any problems that may be encountered with the hardware. A more detailed discussion of selecting microcomputers and developing bid specifications and maintenance agreements are presented in Appendices C and D.

SPACE AND FURNITURE

If the computers are to be used in a classroom there should be space available for as many "stations" as there are computers. Each station should include table top or desk top space for the microcomputer, monitor and disk drive. Each student should have sufficient space to place paper and pencil on the desk or table at his station. The printer should be on a table nearby so it can be used with microcomputers as needed. Software storage must be provided in a cabinet which will keep software dust-free and in a vertical position. Chairs of appropriate height will be needed.

A computer laboratory requires a room about the size of a regular classroom. Computers may be placed on tables or desks with sufficient space for each station as described above if the computers are used as stand-alones. If the computers are networked, it will not be necessary to have a disk drive at each work station. Work space and a chair must be provided for each student. Software storage space should be provided in the lab, according to specifications noted above. (See Appendix F for a more detailed consideration of varied configurations and space requirements for microcomputer systems in classrooms or laboratories.)

ELECTRICAL

See Appendix G for a discussion of electrical wiring.

IN-SERVICE

The training of teachers and administrators in the effective use of microcomputers in instruction is an essential part of any well-developed computer instruction program. Any in-service session should include:

- Information on computers and their uses.
- Preview and evaluation of courseware.
- Instructional uses of computers.

Further in-service for high school educators will naturally depend on the method and curriculum area in which the computers will be used.

IMPAC, with the help of some leaders in computer instruction, has developed a plan for a statewide in-service program which includes three levels of training. While these in-service guidelines have been primarily aimed at educators on the elementary level, these training programs could equally provide the basic computer skills needed for the high school educator or administrator. These courses are currently being offered at most colleges and universities in Arkansas. Level I will provide training required for teachers who use microcomputers for computer-managed, and/or computer-assisted instruction. Level II includes the training needed by instructional leaders to assist in a variety of computer based education programs. Level III in-service offers the training required to serve as a consultant in educational systems and software development and to serve as an in-service training instructor for Level I and II sessions. The above information is more fully developed in Appendix H on In-service Training Level I, Level II and Level III.

Level I in-service is recommended for all teachers using computers in the classroom. Business educators and teachers using the computer for CAI and/or CMI, problem solving and information management will also need additional training in the use of the specific software packages they will be using. Vendors, and in some cases, vocational or general education personnel are sources for this additional training. Computer education teachers will need the equivalent of Level III training, and an advanced programming course in BASIC. Consideration should also be given to training in a second language, Pascal or COBAL. Historically, educators have had to look to the college of math or computer science for the above courses. However, these courses are now being offered in several institutions in Arkansas in the colleges of education, technical education division. See Appendix H for a list of those higher education institutions offering the above training.

APPENDIX A
PLANNING GUIDE

Basic Information

- School District
- Superintendent
- Project Director
- Names, position, training of planning committee members
- Existing programs developed using federal, state or local funds
- Programs developed for possible federal, state or local funding during the current year

Description of each Program (repeat for each program)

- Program objective
- Learner outcomes
- Visits to pilot projects and research involved in establishing objectives
- Grade levels affected
- Number of students affected
- In-service training plan
- Teachers involved and their qualifications
- Microcomputer systems to be used
- Bidding process
- Service and maintenance arrangements
- Specifications for furniture and electrical wiring
- Courseware to be used
- Calendar of activities to implement programs
- Technical liaison person
- Community involvement
- Sources of funds
- Evaluation procedures

Steps in Implementing Microcomputers in Instruction

1. Appoint a local program coordinator
2. Appoint a planning committee and begin Level I, Level II and Level III In-service Training that includes:
 - a. Operating skills
 - b. Terms and definitions
 - c. Educational uses of computers
 - Drill and practice
 - Tutorials
 - Games
 - Simulations
 - Information retrieval
 - Applications programs
 - Materials generation

- d. Ways of scheduling use in building, classroom
 - e. Software evaluation
 - f. Programming
 - g. Microcomputer Instructional Systems
 - h. Designing and developing instructional courseware
 - i. Hardware selection
 - j. Computer Integrations
3. Identify those teachers needing special computer concept training and arrange for in-service by software vendors, higher education institutions or state department personnel.
 4. Develop goals and objectives for instructional applications of microcomputers
 5. Identify software to accomplish objectives
 - a. Cost of software, backups, storage and replacement disks
 - b. Computer capabilities needed
 - c. In-service required
 - d. Classroom management requirements
 6. Find hardware on which software will run
 - a. Determine cost of each computer, peripherals, tables, chairs and electrical wiring
 - b. Estimate cost of maintenance
 - c. Identify how many computers are needed
 7. Estimate number of students affected
 8. How many computers are needed at each building
 9. Determine how much money is available from funding sources (local, state, federal, PTA and business and industry)
 10. Order programs in priority so that greatest needs are met first
 11. Develop a 2 to 3 year timeline to purchase desired hardware, software, train teachers and implement programs
 12. Establish plan for purchase and maintenance of hardware and software.
 13. Establish plan for ongoing support and training of teachers

APPENDIX B
SOFTWARE EVALUATION SOURCES

1. The Digest of Software Reviews: Education
2. Educational Products Information Exchange
3. Minnesota Educational Computer Consortium
4. MicroSIFT
5. The Educational Software Selector

THE EDUCATIONAL SOFTWARE SELECTOR - (TESS)

*Review sources utilized by TESS:

1. Booklist
2. Classroom Computer Learning
3. Curriculum Review
4. Courseware Report Card
5. Educational Computer
6. Electronic Learning
7. EPIE Micro-Courseware PRO/FILES
8. Educational Technology
9. Foreign Language Teaching Programs: A Volume of Reviews
10. InfoWorld
11. MicroSIFT
12. Users, MECC Publications
13. SECTOR Project
14. School MicroWare Reviews
15. The Computer Teacher

Addresses of Evaluation Sources and Estimated Cost:

1. The Digest of Software Reviews: Education
1341 Bulldog Lane
Suite C
Fresno, CA 93710

Estimated cost: \$57.95/year

2. The Educational Software Selector (TESS)
Teachers College Press & EPIE Institute
1234 Amsterdam Avenue
New York, NY 10027

Estimated cost: \$49.95/year

3. Educational Products Information Exchange (EPIE)
P.O. Box 839
Water Mill, NY 11976

Estimated cost: \$360.00/year

4. MicroSIFT
Northwest Regional Education Laboratory
300 S.W. Sixth Avenue
Portland, OR 97204

SOFTWARE EVALUATION FORM

Part I Program Descriptors

1. Title: _____

2. Brief Description: _____

3. Length (in minutes): _____
4. Computer: _____

5. Memory/O-S: _____

6. Format (tape or disk): _____
7. Support Material: _____

8. Subject: _____

9. Topic: _____
10. Grade Level: _____
11. Level of Difficulty (high, medium or low): _____

12. Objectives: _____

13. Prerequisites: _____

COMMENTS: _____

Part II - Instructional Applications

(5 = always appropriate, 1 = never appropriate)

1. Drill and practice	1 2 3 4 5	NA	Comments:
2. Skill maintenance	1 2 3 4 5	NA	
3. Review of facts	1 2 3 4 5	NA	
4. Tutorial	1 2 3 4 5	NA	
5. Concept introduction	1 2 3 4 5	NA	
6. Concept reinforcement	1 2 3 4 5	NA	
7. Small - group activity	1 2 3 4 5	NA	
8. Large - group/class activity	1 2 3 4 5	NA	
9. Simulation	1 2 3 4 5	NA	
10. Experimentation/demonstration	1 2 3 4 5	NA	
11. Data manager	1 2 3 4 5	NA	

Part III - Presentation Quality

(5 = outstanding, 1 = poor)

1. Screen layout	1 2 3 4 5	NA	Comments:
2. Consistency of format	1 2 3 4 5	NA	
3. Content accuracy	1 2 3 4 5	NA	
4. Directions	1 2 3 4 5	NA	
5. Clarity of format/question	1 2 3 4 5	NA	
6. Length	1 2 3 4 5	NA	
7. Use of graphics	1 2 3 4 5	NA	
8. Use of sound	1 2 3 4 5	NA	
9. Error trapping	1 2 3 4 5	NA	

Part IV - Instructional Quality

(5 = outstanding, 1 = poor, 0 = does not exist)

1. Appropriateness of content	1 2 3 4 5	Comments:
2. Appropriateness of examples	1 2 3 4 5	
3. Appropriate level of difficulty	1 2 3 4 5	
4. Sequencing of examples/questions	1 2 3 4 5	
5. Help functions	0 1 2 3 4 5	
6. Use of formative evaluation	0 1 2 3 4 5	
7. Branching	0 1 2 3 4 5	
8. Quality of test items	0 1 2 3 4 5	
9. Number of items/questions	0 1 2 3 4 5	
10. Use of review	0 1 2 3 4 5	
11. Introduction	0 1 2 3 4 5	

SOFTWARE EVALUATION FORM

Reviewer's Name: _____ Date of Review: _____

Address/Phone: _____

Program Title _____ Medium: _____ 5" disk, _____ 8" disk

_____ cartridge, _____ tape

Package Title _____ Copyright Date (if any) _____

Microcomputer (brand, model, memory) _____

Necessary Hardware _____ Necessary Software _____

Producer _____ Author(s) _____

Back-up Copy Policy _____ Cost _____

PART 1 - PROGRAM OVERVIEW AND DESCRIPTION

1. Subject area and specific topic _____
2. Prerequisite skills necessary _____
3. Appropriate grade level (circle) 1 2 3 4 5 6 7 8 9 10 11 12 college _____
4. Type of program (check one or more)

☐ Simulation	☐ Testing
☐ Educational Game	☐ Classroom Management
☐ Drill and Practice	☐ Other (specify) _____
☐ Tutorial	☐ Remediation
☐ Problem Solving	☐ Enrichment
5. Appropriate group instructional size: _____ individual _____ small group _____ class
6. Is this program an appropriate instructional use of the computer? _____
7. Briefly list the program's objectives. Are they clearly stated in the program or in the documentation? Are they educationally valuable? Are they achieved?

8. Briefly describe the program. Mention any special strengths or weaknesses.

PART 2 - EVALUATION CHECKLIST

Please check Yes, No or Not applicable for each question below. To add information, or to clarify an answer, use "Comments" at the end of each section.

YES	NO	N/A	EDUCATIONAL CONTENT
☐	☐	☐	1. Is the program content accurate?
☐	☐	☐	2. Is the program content appropriate for intended users?
☐	☐	☐	3. Is the difficulty level consistent for material, interest and vocabulary?
☐	☐	☐	4. Is the program content free of racial, sexual or political bias?

Comments: _____

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YES	NO	N/A	PRESENTATION
_____	_____	_____	1. Is the program free of technical problems?
_____	_____	_____	2. Are the instructions clear?
_____	_____	_____	3. Is the curriculum material logically presented and well organized?
_____	_____	_____	4. Do graphics, sound and color, if used, enhance the instructional presentation?
_____	_____	_____	5. Is the frame display clear and easy to read?

Comments: _____

YES	NO	N/A	INTERACTION
_____	_____	_____	1. Is the feedback effective and appropriate?
_____	_____	_____	2. Do cues and prompts help students to answer questions correctly?
_____	_____	_____	3. Can students access the program "menu" for help or to change activities?
_____	_____	_____	4. Can students control the pace and sequence of the program?
_____	_____	_____	5. Are there safeguards against students "bombing" the program by erroneous inputs.

Comments: _____

YES	NO	N/A	TEACHER USE
_____	_____	_____	1. Is record-keeping possible (within the program or through documentation worksheets)?
_____	_____	_____	2. Does teacher have to monitor student use?
_____	_____	_____	3. Can teacher modify the program?
_____	_____	_____	4. Is the documentation clear and comprehensive?

Comments: _____

PART 3 - OVERALL EVALUATION

Check One.

- _____ Excellent program. Recommend without hesitation.
- _____ Pretty good program. Consider purchase.
- _____ Fair. But might want to wait for something better.
- _____ Not useful. Do not recommend purchase.

**Evaluation form developed for general use by Granite School District, Salt Lake City, Utah
 --Copy as needed--

Your Name _____ Organization _____ Position _____
 Address _____ Tel: _____
 Product Name _____ Supplier _____ Price \$ _____ No. of Progs. _____
 Subjects and Grades _____ Est. Student _____ Under This Name _____
 to Which Applicable _____ Time Required _____

FUNCTIONAL DESCRIPTION - Describe the program in terms of its goals and what it does to achieve them. Give as much detail as possible (use extra sheets as necessary).

PRELIMINARY CONSIDERATION - Does this program contribute to the teaching of topic(s) which should be taught in today's schools? Yes _____ No _____ If No, give your reasons for this answer in the Comments section at the end of the form and omit the balance of the questionnaire.

INSTRUCTIONS - Enter a number in the blank to indicate the extent to which the product fulfills the description in the item, as follows: 2 - Completely, 1 - Partially, 0 - Not at All. If the item is not applicable to the product, enter N/A. If the item is unclear, enter U. Elaborate on answers as necessary in Comments at end or on extra sheets, giving item numbers.

DOCUMENTATION - List materials accompanying the program, e.g., teachers guide, student workbook.

1. Indicate types of information included.
 - a. Suggested course/subject, grade levels.
 - b. Goals.
 - c. Performance objectives.
 - d. Suggested teaching strategy(ies).
 - e. Correlation with standard texts.
 - f. Prerequisites for use of program.
 - g. Student exercises, teacher answers.
 - h. Operating instructions.
 - i. Listing and sample runs of program(s).
 - j. If a simulation, description of the model used.
 - k. Suggested topics for follow-up discussions.
1. Suggested references/activities for follow-up.
2. The documentation is written clearly.
3. If a workbook is included, the format and content are appropriate.

INSTRUCTIONS GIVEN TO USER BY PROGRAM

1. The instructions are adequate regarding:
 - a. The instructional task to be performed.
 - b. Details of how to interact with the program.
2. User has the option of skipping instructions if already known.

STUDENT-COMPUTER DIALOG

1. Output is displayed screen by screen (paged) rather than scrolled.
2. If output is paged:
 - a. User has control over continuing to the next page.
 - b. Amount of information in each page is appropriate.
 - c. The perceptual impact (amount of type and lines) is suitable.
3. Output is spaced and formatted so as to be easily readable.

4. Language is well suited to most students' reading ability.
5. Uses correct grammar, spelling, hyphenation and punctuation.
6. Any grid or coordinate system used is consistent with common conventions.
7. Students can respond with common symbols & ways of using them, e.g., right to left entry of sums.
8. Accepts abbreviations for common responses.
9. Provides for individual needs, e.g., opportunity to work with harder or easier material.
10. Dialog is personalized, i.e., makes appropriate use of student names.
11. Uses devices to get & maintain interest, e.g., variation of computer responses, humor, pace change, surprise.
12. Makes good use of any special features computer:
 - a. Graphics
 - b. Color
 - c. Sound
13. Reinforcing responses (indications of right, wrong, etc.) are appropriate.
14. The number of wrong answers allowed is reasonable.
15. Responds appropriately if allowed number of wrong answers is exceeded.
16. Provides opportunity to get help if difficulty is encountered.
17. Minimizes bad entries via devices such as objective formats (multiple choice, etc.).
18. Deals well with inappropriate entries, i.e., response to typing errors, etc., is intelligible and useful.
19. Required entries are within students' capabilities (esp. typing, vocabulary).
20. Reports student performance periodically and at end of session.

MISCELLANEOUS CONCERNS

1. If a simulation, the program gives a sufficiently accurate representation of the situation simulated.
2. The concepts and vocabulary required to use the program are reasonable.
3. Operates properly and is free of bugs.
4. Is well structured and documented internally to facilitate any necessary debugging/modification.

COMMENTS - Please use this space and additional sheets as necessary to provide any information which you believe would help someone who is thinking about buying of the product being reviewed. In particular, indicate what you like best and least about the program. Also, list any changes which should be made.

BEST COPY AVAILABLE

APPENDIX C

SELECTING A MICROCOMPUTER AND PERIPHERALS

The decision facing many educators at this time is which of the several microcomputers that are currently available should be considered for purchase by the local school district. Unfortunately, there is no precise set of factors that can lead to a "best brand" selection because there is no single microcomputer that is right for every educational situation. The identification of the specific classroom applications of a microcomputer system, a hands on familiarity or on-site observation, a detailed listing of the microcomputer configuration and the availability of quality courseware are aids to hardware selection.

The following observations do not provide a recipe for successful hardware selection. However, these statements are the result of careful thought about the essentials in selecting microcomputer systems for instructional applications at the elementary school level.

- A. Sufficient courseware and educational documents are available for high schools to give consideration to the purchase of the Apple IIe, Radio Shack Model II, III or IV, and the IBM-PC compatibles (MS-DOS operating systems) such as the Tandy 1000 and the Sperry PC. This statement is not intended as an endorsement of a particular microcomputer system nor is it to be considered as an inclusive list.
- B. Any microcomputer system should include at least a CPU with a minimum of 128K RAM memory, a monitor designed for use with that specific computer and a disk drive. Many application software packages such as word processors or spreadsheet programs may require as much as 256K. Future needs should also be assessed to determine if the system under consideration has the expansion capabilities necessary in meeting long-term goals.
- C. In the case of classroom configurations involving more than four (4) microcomputers, consideration should be given to the inclusion of a printer. A bi-directional tractor feed printer is recommended. Investment in a letter quality printer is not recommended.
- D. Except for special function keys related to graphics and data entry, the keyboard should function like a regular typewriter (QWERTY) keyboard so that good keyboarding skills may be developed.
- E. Microcomputer systems purchased in quantity should be capable of networking to either a floppy disk or hard disk in sets of at least four (4) systems. Networks of up to 32 systems involving a hard disk have been effectively utilized in a school setting. Flexibility in microcomputer configurations is imperative for cost effective applications over a five (5) year period.
- F. Color, sound and high resolution graphics have been essential to quality courseware. Expenditures for these features as extras should be justified on the basis of their effectiveness in concept development courseware.

Compatibility of Software and Hardware

Software programs are stored on a diskette in such a way that only certain microcomputers, without modification, can run the programs. The program instructions are organized on the diskette according to a certain format. The microcomputer loads and runs the program using the disk operating system which is designed to read the program instructions off the diskette. The most common disk operating systems for which there are large amounts of courseware are Apple 3.3, Commodore DOS, TRSDOS, MS-DOS and CP/M. Some microcomputers with additional chips or special systems software can run programs formatted using one or more of these disk operating systems. For instructional applications, schools are advised to purchase only microcomputers that have disk operating systems that will load and run courseware that is expected to remain in abundant supply. When purchasing various pieces of hardware (printers, disk drives, computers) care should be taken that all hardware items are compatible.

Microcomputers have a variety of features and capabilities. It is important to evaluate each system under consideration in terms of its ability to meet the district's instructional needs. The following list includes the factors that should be considered in the assessment of microcomputer systems.

Cost - The cost of microcomputers for educational purposes varies greatly from less than three hundred to about four thousand dollars. Cost comparisons must be made in relationship to machine capabilities and software programs that are available. Cost most often reflects memory size, language capacity and the type of storage device available. When comparing costs of various machines, remember to be sure to compare machines with similar configurations and capabilities.

Memory - There are two kinds of memory in a computer - RAM (random access memory) and ROM (read only memory). The RAM determines the size of the programs that can be run on the microcomputer. A program requiring 64K of memory will not run on a computer that has only 48K memory. The ROM is used for storing programs that are generally put in by the manufacturer as part of the operating system of the computer. The amount of memory available will often limit the courseware that can be run on the computer. A 128K memory is considered a minimum for courseware presently being developed.

Peripherals - These are devices that are accessories to the computer; however, often the computer will not function properly without certain peripherals.

- a. Floppy or hard disk drives - These are used to augment the memory capacity of the microcomputer. These devices can store and play back programs. Hard disk drives are more expensive than floppy disk drives, but provide faster and more reliable storage and retrieval of information. Hard disk drives are usually used when microcomputers are networked.
- b. Printers - If printed hard copies of student records or instructional prescriptions are desired, or if the microcomputer is to be used for word processing, the purchase of a printer is essential. The types of printers that can be used with a given microcomputer should be determined, as should the supportive items such as an interface card that may be necessary to use

the printer. The printer's speed and ability to reproduce graphics should be considered. Basically two types of printers are available (1) a dot matrix printer and (2) the letter quality printer. The letter quality printer will be much more expensive and is only necessary if high quality manuscripts produced through word processing are to be done.

- c. **Monitor** - The purpose of a monitor is to have a screen display of the output of the computer. In some microcomputers the monitor is built into the main unit. In others, it is detached and considered a peripheral. When this is the case, the monitor selected should support the hardware purchased. Television sets can be used as monitors for some microcomputers. Generally a monitor has a higher degree of resolution and is more reliable than a television set. If the computer has color capabilities, consideration should be given to purchasing a color monitor. Generally, if the computer is to be used for word processing the green or amber screens are recommended.
- d. **Modems** - Modems allow microcomputers to "talk" to other computers over telephone lines. A modem would give the microcomputer access to information networks as well as potentially enabling it to be used as a "dumb terminal" for communication with other computers. In Arkansas the microcomputer is currently being used to connect schools and the Department of Education through Connect*Ed. Instructional applications of modems is limited at the elementary school level.

Software - Collectively the programs that are loaded into the computer are known as software. Complete instructional packages for computer-assisted instruction/computer-managed instruction are referred to as courseware. Generally, software is available to suit a variety of educational needs. There is a wide variety in the quality and the availability of specific items for a particular machine. The software market is rapidly expanding; however, there is no assurance that educationally effective software developed for one computer will eventually be adapted for other models. An attempt should be made to determine the availability of software and materials to meet the stated objectives for the school program.

Screen Display - The options for screen display ranges from 20 to 80 characters in width and 16 to 32 lines. Many microcomputers have upper case letters only.

Graphics - The greater number of dots or blocks that can be used to display a graphic, the higher the resolution (greater the detail). Some computers are capable of character graphics programming while others have higher resolution graphics. Many programs such as LOGO will not run on machines with only character graphics.

Keyboard - There are two basic types of keyboards available on computers. The typewriter-like unit with keys you depress and a flat (membrane) unit with keys drawn on a smooth surface that is pressure sensitive. Students with any keyboarding experience will respond positively to the typewriter-like feature. Many keyboards feature special function keys - these are generally preferred if they are not accessed by the regular typewriter keyboard. Another option that is often a major consideration is the presence of a separate number pad.

Sound and/or Music - This feature comes standard on some microcomputers and can be added at additional cost on other models. Sound is usually considered a motivational feature for young users.

Color - Computers that have color capabilities display a range of 4 to 16 colors. Color is a consideration in the reinforcement and motivation of young students, for highlighting, contrasting, or increasing the appeal of the program.

Networking and/or Expansion - To lessen the cost for peripherals such as disk drives and/or printers, networking capabilities can be explored. Care must be taken in assessing the networking capabilities so that the desired courseware will in fact work on the network. Most of the "protected" programs from commercial sources will not load onto the network without modification. Several expansion capabilities are available for additional costs including interactive videotape and videodisc connections.

Languages - BASIC (Beginners' All Purpose Symbolic Instruction Code) is the most common language for the microcomputer. Microcomputers differ in the type of BASIC used. One should not assume that software written for one brand of microcomputer will run on another brand. Many computers have the capability of being programmed in other languages. To adjust the computer for use with other languages requires the purchase of a language modifying item such as a language card or cartridge. The following languages are sometimes used:

- a. Pascal - This structured language is useful for those interested in more advanced computer programming.
- b. Pilot (or other authoring languages) - This authoring language allows teachers with no programming experience to write computer-assisted instruction programs for use with their own classes. However, such courseware is seldom cost effective when compared to good commercial courseware.
- c. Fortran (Formula Translation) - This scientific language is useful for dealing with problems in science and engineering.
- d. LOGO - This highly interactive language is designed primarily for use with young children.

APPENDIX D

EQUIPMENT BID SPECIFICATIONS AND MAINTENANCE AGREEMENTS

When securing equipment, consideration should be given to the development of bid specifications and maintenance agreements. Such specifications and agreements cause the local school district to describe specifically what equipment is to be purchased, the appropriateness of functionally equivalent equipment and the type of maintenance expected.

In most cases the school district should require that a vendor bid on the entire system as a prime contractor. The selected contractor should be required to assume all responsibility for the equipment and be the primary point of contact with regard to equipment, maintenance and support. The vendor should be an authorized service dealer for the microcomputers being bid.

Criteria for evaluating microcomputer systems in the context of a bid are being used in the evaluation of bids submitted relating to IMPAC programs. You are encouraged to use this criteria in evaluating bids. Certainly the criteria reveals in part the Commission's view that evaluation of bids may be an important process especially in large equipment orders.

1. EVALUATION CRITERIA RELATED TO EQUIPMENT SPECIFICATIONS

The selection process should be based on a predetermined methodology and set of evaluation criteria. The evaluation criteria should reflect the following objectives and considerations:

- a. The ability of the vendor to satisfy the school's overall computer based instruction goals
- b. Meeting the minimum mandatory requirements set forth in the specifications
- c. The total cost of the system, including transportation, installation, maintenance and training
- d. The level of vendor assistance, aids and promptness of the installation effort
- e. The level of vendor maintenance support for the hardware
- f. The number and type of vendor references specified
- g. Emphasis should be placed on the clarity and conciseness of vendor proposals. Failure to completely meet any one of the mandatory requirements including bid format and submission of the required number of copies at the time of bid opening, may be sufficient cause for rejection of the vendor's proposal.

In addition to the criteria noted above, the skills, facilities, experience, previous work and financial standing of the bidder; and the quality, efficiency and construction of the equipment proposed to be furnished should be considered.

2. MAINTENANCE SUPPORT REQUIREMENTS

The vendor should assume total responsibility for all the hardware purchased. Any vendor proposing the hardware in response to a bid should certify that maintenance can and will be provided in accordance with bid requirements.

Maintenance service should be available to the school on-call from 8 a.m. to 5 p.m., Monday through Friday. This plan should offer, during the principal period of maintenance, a minimum of next day response to a trouble call. The maintenance plan bid should describe how the bidder will provide maintenance service, identify all parts required and outline all associated costs.

If any component in the computer based instruction system remains inoperative for more than seventy-two (72) hours from time of notification of failure, the school district should reserve the right to exercise the following options:

- a. Suspend payment of maintenance on the malfunctioning system(s) or machine(s) rendered unuseable. Maintenance payments would resume at such time the system(s)/machine(s) are returned to an acceptable service level determined by the school district.
- b. Allow the vendor to replace malfunctioning system(s) or machines(s) with equipment of equal or greater capacity at no expense to the school district.

Contracted monthly maintenance should be proposed and begin after expiration of the defined warranty period offered in the bid. If maintenance charges are to escalate from year to year during the maintenance contract period, a maximum annual percentage rate of increase should be stated and evaluated as such. Escalative charges should only be put into effect at the beginning of the school district's fiscal year (July 1) and only if preceded by 90 days written notice. Maintenance charges should be stated on a per unit basis.

Time-and-material maintenance should be proposed and begin after expiration of the warranty period offered in the bid. Bidders should state the period of time all associated costs for such service will remain in effect. A bidder should state their experience factor as regards mean time between failure for the equipment proposed.

A bidder should provide a toll-free telephone number (or one which will accept collect calls) through which the school district may obtain operational diagnostic assistance for hardware.

A bidder should provide a detailed explanation of both maintenance programs proposed by the vendor to provide service at the school district so as to insure attainment of a goal of maximum up-time. The explanation should address the following points.

- a. Parts supply and availability
- b. Technical personnel support giving numbers and skill levels
- c. Backup support for technical personnel
- d. Backup equipment availability
- e. Length and terms of warranty on each system/software
- f. Average turn-around time for requested remedial maintenance
- g. Time and material rates
- h. A list and cost of any spare parts that the bidder suggests the school district should keep on-hand

The school district should be able to select either monthly contracted or time and material maintenance plans. However, the cost of the bidders proposal should be either a monthly or time and material contract for maintenance of equipment.

Delivery and Installation of Equipment

Delivery and installation of all hardware should be completed within a specified (usually 30-45 days) time after bid award.

The bidder should assume responsibility for:

- a. arranging for equipment transportation to specified school district receiving center
- b. the risk of loss and/or damage during shipment of all equipment
- c. the installation of all the microcomputer systems excluding preparation of the physical facility
- d. outlining in detail the requirements for required modification of the physical site, if any, to accommodate installation of the proposed hardware
- e. all necessary cabling
- f. describing in detail their methodology and criteria for acceptance testing and certification of each system as "customer ready"

Bidders should describe the remedial action to be taken following certification of system as "customer ready" in the event any system fails to meet the school district's standards. A performance (90% overall up-time) calculated as follows is recommended:

$$\frac{(\text{Productive time} - \text{Downtime})}{\text{Productive time}} \times 100 = \text{Uptime percentage}$$

Productive time is defined as those periods during which the system is scheduled for operational use by the school district.

Acceptance of Equipment

The school district should provide a letter of acceptance when all requirements under specifications have been met.

Training

Formal customer training courses for use of the hardware should be required if needed and should be detailed as to cost and content in the vendor proposal. The bidder should provide a specified number of hours of training for the school district.

On-site training should be specified for the teachers in the operation of the hardware after the equipment has been delivered, installed and tested for operation in accordance with the manufacturers specifications. It is recommended that training be available within fifteen (15) days after the hardware becomes available for operational use.

Documentation/Manuals

Documentation for each of the microcomputer systems should include, at a minimum, the following:

- a. User procedure manual for microcomputers
- b. Microcomputer system manuals
 - (1) System operating manual
 - (2) Maintenance manual
- c. Courseware manuals (if any)

The bidder should provide unit costs for all documentation identified above that would apply to subsequent school district purchases.

Bidders should state their policy as regards reproduction of manuals for the exclusive use of school district employees and students for educational purposes.

Pricing

All charges associated with the proposed hardware should be included on the Bidders Price Sheet and should be included in the costing evaluation. These prices should include the following:

- a. Equipment pricing
- b. All cabling costs, if additional
- c. Maintenance costs
- d. Maximum amount of annual increase in maintenance cost which the vendor may charge (NOTE: This should be quoted in terms of maximum dollar or percentage increase over previous year)
- e. Shipping date estimate and anticipated date of installation
- f. Installation charges, if any

Summary

In preparing a bid be sure to cover the following items:

- A. Accept bids only from authorized service dealers.
- B. Detail description of equipment
- C. Vendor clarification of warranty and how equipment will be repaired or replaced
- D. Clarification of maintenance available after warranty
- E. Expectations for on-site installation, including electrical requirements, set up and certification that equipment is working using performance test
- F. Training and orientation of staff
- G. Documentation manuals and software required to use the system
- H. Prices on each item in the main bid request
- I. Terms of payment
- J. Length of term of the bid
- K. Prices of optional items that enhance the use of the system should be included since diskettes, diskette boxes, computer covers, power block switches, paper and ribbon will be needed eventually.

APPENDIX E
Computer Science
Course Content Guide Committee

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Resource People

Numerous questions will arise as you work to design and implement your computer education program. Most questions and problems that you will encounter have been solved by others. The educators in the following list have worked with the problems of implementing computer education programs. While this list is by no means inclusive, it does represent available resource people throughout the state.

Resource People

- Beverly Williams - Math Coordinator
Pulaski County Special School District
Little Rock
- Suzanne Mitchell - Math Coordinator
Pulaski County Special School District
Little Rock
- Terry Massengalle - Computer Science Teacher
Alma High School
Alma, Arkansas
- George Roff - Assistant Superintendent
Paragould School District
Paragould, Arkansas
- Brenda Cantwell - Westark Community College
Fort Smith, Arkansas
- David Woolly - Administrative Assistant
Alma School District
Alma, Arkansas
- Tommy Flud - Computer Science Instructor
Mt. Judea High School
Mt. Judea, Arkansas
- Wayne Haver - Principal
Southside High School
Fort Smith, Arkansas
- Darrell Donaldson - Superintendent
Hampton School District
Hampton, Arkansas
- David Loertscher - Program Coordinator Instructional Resources Education
University of Arkansas
Fayetteville, Arkansas

Tom Bishop -	Department of Computer Science, Math and Physics Arkansas State University Jonesboro, Arkansas
Elbert Frazier -	Computer Science and Math Teacher Jonesboro High School Jonesboro, Arkansas
Ben Bowman -	Computer Coordinator Mark Tree School District Mark Tree, Arkansas
Gerald Parks -	Principal Richland Elementary School West Memphis, Arkansas
Chester Warnick -	Computer Science Instructor Hoxie High School Hoxie, Arkansas
Debbie Bassham -	Math and Computer Science Instructor Highland High School Highland, Arkansas
Dorinda Crews -	Special Programs Coordinator Hamburg School District Hamburg, Arkansas
Bill Allen -	Director Data Processing Department Quachita Baptist University Arkadelphia, Arkansas
William Dempsey -	Director of Microcomputers Texarkana School District Texarkana, Arkansas
Geneva Bowlin -	Teacher Conway Middle School Conway, Arkansas
Betty Bitner -	Instructor Arkansas Tech University Russellville, Arkansas

APPENDIX F
CLASSROOM FACILITIES

The required computer access time by the students will determine the type of computer configuration needed. Software that performs the desired function should be chosen and the weekly computer time for each student should be determined. Then, by using class period length and class size, the total number of computers needed can be computed. For example, if the software interaction time requirement is 90 minutes per week per student, 30 minutes are allowed per class period for computer use and the class size is 25, then 15 computers would be required.

25 students x 90 minutes = 2,250 minutes

5 days per week x 30 minutes per day = 150 available minutes per week on each computer

2,250 : 150 = 15 computers needed

There are several configurations of microcomputer systems that are likely to become standard in secondary schools. These include:

- A. Classrooms with a small network arrangement or stand alone units.
- B. A laboratory using 12 or more microcomputer systems networked to a dual disk drive or a hard disk drive.
- C. Media centers utilizing microcomputer systems to provide greater computer access time for students.

Networks

Advantages:

- 1. Software can be shared by computers
- 2. Peripherals can be shared by computers
- 3. Access to programs and data is faster
- 4. Large volume of programs can be accessed

Disadvantages:

- 1. Higher cost of software
- 2. Higher cost of installation
- 3. More training is needed

Stand Alones

Advantages:

- 1. System is easier to operate
- 2. More flexibility in location of computers
- 3. More software is available at this time

Disadvantages:

- 1. Multiple copies of software are needed
- 2. Access time to programs and data is slower

REGULAR CLASSROOMS

Electrical

Electrical powers to the microcomputer systems should be stable and noise free if possible. Ensure a good ground is present, and if practical, ensure that only the computers and other light equipment are used on the selected electrical circuit. Each microcomputer system requires at least three electrical outlets (microcomputer - monitor - disk drive). Also a printer (one additional electrical outlet) is usually provided for every four microcomputer systems. This is the minimum configuration recommended for a school classroom. Power surges are common in most school districts. A power surge protection device with a current filter and four outlets should be plugged into the wall receptacle. An extension cord from each of these outlets should extend to each microcomputer system and provide four outlets for the system's components. Once a system is out of warranty, extensive damage from power surges is the school district responsibility. Insurance that covers theft and storm damage should be considered. A switch that turns all systems on or off at the same time is recommended. This is very useful at the beginning and end of each school day and during electrical storms.

Lighting

No special lighting is required. This assumes that the room meets recommended standards for a regular classroom. Microcomputer systems should not be placed near heating or cooling units, or located so that students face windows without shades. Try to avoid configurations that would result in glare off the monitor screens.

Floor Coverings

No special floor coverings are required. However, concrete floors are not recommended due to excessive dust. Vinyl tile covered floors are good. If carpet is installed, it must be static free and cleaned properly to remove dirt and dust particles.

Furniture

Tables (with non-folding or lockable legs and wood table tops) should be at least 30 inches wide, appropriate height depends on grade level, and at least 6 feet in length. The station using the printer will need two additional feet of length. This means in a typical elementary classroom, one 6' table, one 8' table, 4 chairs and appropriate electrical wiring will be needed. Space needs for such a configuration, as well as other configurations are given below:

<u># Systems</u>	<u># 6' Tables</u>	<u># 8' Tables</u>	<u>Chairs</u>	<u>Minimum Room Space Needed</u>
2	0	1	2	48 sq. ft.
4	1	1	4	84 sq. ft.
6	2	1	6	120 sq. ft.

MICROCOMPUTER INSTRUCTION LABORATORIES

Electrical

In addition to the electrical outlets required for each microcomputer system (microcomputer, monitor and disk drive) - an outlet is needed for at least one printer, a hard disk drive and disk server. Laboratories with 16 - 24 microcomputer systems are recommended if one-half or all of the students use the lab during a given time block (usually 20-30 minutes). Microcomputers are networked together using a small trunk line, wire or cable that carries signals. The trunk line should be secured on the back or underside of tables so that students cannot kick the line with their feet while working on the computers. Install or ensure that dedicated electrical circuits are used in networks. "Dedicated" means that nothing other than the computer system can be plugged into these circuits. The circuit also needs a good earth ground.

A switch that turns all the systems on or off at the same time is recommended. Such a switch should be put inside a lockable case in order to protect against accidental switching.

Lighting

Shades may be needed since, regardless of the room arrangement, glare will be a distracting factor.

Floor Covering

No special floor coverings are required. However, concrete floors are not recommended due to excessive dust. Vinyl tile covered floors are good. If carpet is installed, it must be static free and cleaned properly to remove dirt and dust particles.

Furniture

Follow the recommendations given for tables under the a regular classroom. However, an entire classroom will be needed for any given laboratory configuration. An extra 8' table is needed as a teacher control-monitor station.

<u># Systems</u>	<u># 6' Tables</u>	<u># 8' Tables</u>	<u>Chairs</u>	<u>Minimum Room Space Needed</u>
16	6	2	16	312 sq. ft.
24	10	2	24	456 sq. ft.
30	14	2	30	600 sq. ft.

APPENDIX G
ELECTRICAL REQUIREMENT

Is the electrical power to your classroom clean? The electrical outlets for your computers should provide steady reliable power. This is most important when computers are tied together via a high speed communications "local area network" (LAN)

Electrical power utilities are often blamed for "dirty power" but most induced current affecting microcomputers and computer networks is generated after it leaves the main source and before it arrives at the classroom outlet. Most of these electrical power problems are of the following types:

- 1) Brown-outs (low Voltage on an electrical distribution system) may be caused by localized overloads between the main commercial power system and local distribution, uncontrolled area wide reduction of voltage caused by extremely heavy demand over a large area, and controlled deliberate wide reduction of voltage by the power company to prevent a blackout.
- 2) Black-outs or power outages (no electrical power in a given locale or large area) may be caused by an overload condition within your school building (the circuit breaker trips), a local distribution failure (a pole mounted transformer or circuit breaker is damaged) and a power failure caused by large area wide problems.
- 3) Alternate current (AC) line irregularities may exist due to at least six causes: lightning discharges from a flash occurring up to several miles away; switching of nearby inductive loads from motors, air conditioners, fans or large relays; electrostatic discharges or static electricity; nearby radio and television stations; loose electrical connections and fluorescent lights.

Causes of "dirty power" or... "noise" may be miles away, in the building next door or in the room down the hall. Almost never attributed to a single source, they are usually the sum of numerous disruptive influences. There is little the electric power company can do. It is the user's responsibility to protect his or her equipment against these problems.

Normally, educational microcomputer systems are not protected from brown outs and black outs. If the power goes off, fluctuates or electrical thunderstorms are in the area, the teachers should turn off the computers or shut down the computer network. After it has been verified that the power is good, the teacher may turn on the computer systems again.

If the electrical power to the computers is on a dedicated circuit with little inductive noise and well-grounded, surge protectors will generally be adequate.

Line irregularities can be reduced. A licensed electrician should be used for this task. You should share the following directions with the electrician. Feel free to contact the IMPAC office if clarification is needed.

Ensure that the electrical outlets that will be used by the computer systems are noise free and well-grounded. If they are not, take the following steps:

Install a dedicated circuit from each room back to a common circuit breaker panel. Each conduit should carry only one circuit - a hot, a neutral and a ground wire. Connect these wires to "isolated ground outlets" in the room and to the circuit breaker, a neutral bar and ground bar in the circuit breaker panel. A good earth ground should be established at that common circuit breaker panel. We recommend driving a grounding rod below that panel. All conduits should be secured tightly. The circuit breaker panel box should be bonded to the earth ground and to the ground wire from the conduit.

It is important that all computer systems that are tied together through networks have the same ground reference (no electrical potential should exist between the ground in one outlet or plug versus another).

If possible, try to balance the electrical load by using all phases of electrical power. For example, if there are six classrooms involved, install a dedicated circuit to two of the rooms using phase A, put two rooms on phase B and two on phase C.

The quality of the electrical power is critical to a microcomputer network. The electrical wiring should be certified as acceptable by a qualified licensed electrician following network specifications. The IMPAC educational technologist should be contacted if you have any questions. Good clean electrical power is a must for a network.

APPENDIX H
IN-SERVICE PROGRAMS

Most colleges and Universities in Arkansas are offering courses that meet Level I guidelines. Additional training on the Level II or III can be obtained at those institutions listed below. This list is not intended to be all inclusive and any college or university that offers Level II or III training can be added to this list by notifying the Project IMPAC staff at (501) 371-1401.

Level II:

Westark Community College

Harding University

Ouachita Baptist University

Henderson State University

University of Arkansas at Monticello

University of Arkansas at Pine Bluff

University of Arkansas at Little Rock

University of Arkansas at Fayetteville

Arkansas State University

Arkansas Tech

Level III:

University of Arkansas at Little Rock

University of Arkansas at Fayetteville

Arkansas State University

Arkansas Tech

Introduction to Microcomputers and their Instructional Applications In-service Training Level I

Any teacher involved in instructional applications of microcomputers needs a minimum of 24 clock hours of pre-service or in-service instruction. The training should involve one of the actual computers and other associated hardware to be used by the teacher. Software comparable to the software to be used in classroom instruction should also be available. Teachers should develop the ability to understand the capabilities of microcomputer technology as it relates to computer-managed and computer-assisted instruction in a self-contained, departmental or laboratory setting.

The following is an outline of a recommended 24 clock hour course that should meet the objectives stated above:

A. KEYBOARDING SKILLS - 2 hours

1. Identification of the keys, the role of each and especially those that perform special functions when the student interacts with software.
2. Break and reset
3. Clear screen procedure
4. Special and multiple function keys

B. INTERACTING WITH SOFTWARE - 4 hours

1. Loading and saving a program
2. Auto and soft disk boots
3. Running and controlling a program
4. Interacting with courseware
5. Break and reset technique
6. Obtaining and working from a menu
7. Keying in short programs and executing

C. TERMINOLOGY - 3 hours

1. CPU/ROM/RAM
2. Input/output
3. Cassette/floppy disk/hard disk
4. Monitor: Display characteristics and capabilities
5. Load, Save, Run, List
6. Motherboard/bus
7. Catalog/directory

D. MICROCOMPUTER INSTRUCTIONAL SYSTEM - 4 hours

1. Microcomputer with ROM and RAM
2. Monitor and keyboard
3. External storage - floppy disk and hard disk
4. Printer
5. Floppy disk characteristics and usage
6. Utility programs
7. Clock/counter/random number generators

- E. INSTRUCTIONAL USES - 4 hours
1. Networks
 2. Categories of computers used in education
 3. Specific CAI strategies
 4. Definitions of cost effectiveness
 5. Strategies for maintaining technology awareness
 6. Selecting software keyed to objectives
 7. Classroom instructional management and organization
- F. COURSEWARE EVALUATION - 4 hours
1. Evaluation criteria/evaluation forms
 2. Sources of courseware evaluations
 3. Matching courseware and instructional objectives
 4. Pricing techniques
 5. User groups
 6. Public Domain
 7. Vertical files of courseware
 8. Backups
- G. ISSUES RELATED TO COMPUTER BASED INSTRUCTION - 2 hours
1. Cost justification
 2. Literacy
 3. High tech jobs in perspective
 4. Copyright laws
 5. Courseware/hardware compatibility
 6. Equity in access to computers
 7. Budget priorities
 8. Privacy
- H. A VIEW TO THE FUTURE - 1 hour
1. Evolution of computers and their impact on society
 2. Authoring languages
 3. LOGO/PILOT
 4. Word processing
 5. Interactive video
 6. Minicomputer systems
 7. Textbook/courseware supplements
 8. Handheld computers/cartridges of courseware

Planning and Coordinating Instruction Applications
of Microcomputers Level II Training

Instructional coordinators should be prepared to help teachers with Level I training to use computers as instructional and management tools. The coordinator should be able to help teachers incorporate the use of computers into their instructional program. This involves the designing of unit or single lesson plans, evaluation of courseware, instructional strategies and the selection of the components of microcomputer systems. The training of the instructional coordinator should place emphasis on instructional strategies, introductory programming skills and microcomputer systems appropriate to meet specific educational objectives over a five (5) year period. A recommended course outline is given below and assumes an equivalence of prior Level I training.

- A. Scope of Computer-Assisted Instruction Activities - 6 hours
 - 1. Drill and Practice
 - 2. Tutorial
 - 3. Simulation
 - 4. Gaming
 - 5. Problem solving
 - 6. Word processing
 - 7. Criteria for selection of appropriate instructional activity
- B. Software Evaluation and Selection - 9 hours
 - 1. Software review guidelines
 - 2. Sources of reviews
 - 3. Selection of software relative to instructional objective
 - 4. Technical requirements - RAM/hardware/language
 - 5. Pricing
 - 6. Vertical files of software
 - 7. Organizing and maintaining a software library
 - 8. Maintenance of software and hardware
- C. Integrating Computers into Instructional Units - 6 hours
 - 1. Research on CAI
 - 2. Laboratory/stand alone
 - 3. Scheduling and supervising CAI/time on task
 - 4. Modes of instruction - drill and practice/tutorial/games
 - 5. Formative and summative evaluation
- D. Instructional Support Software - 9 hours
 - 1. Computer-managed instruction/tracking student progress
 - 2. Data base systems
 - 3. Word Processing
 - 4. Spreadsheets
 - 5. Teacher Utilities
 - 6. Testing and evaluation programs
- E. Programming Skills - 9 hours
 - 1. Flow charts
 - 2. Introduction to Basic
 - 3. Other instructional languages
 - 4. Introduction to graphics, sound and color

F. Developments in Computer Technology - 3 hours

1. Brief history of computers
2. Applications of computers in business, government, medicine and science and industry
3. Limitation of computers
4. Privacy issues
5. Information processing and distribution
6. Modems/Compuserve/The Source

G. Microcomputer Instructional Systems - 6 hours

1. Types of microcomputers and standard features/hardware evaluation
2. Peripheral devices
3. Future trends

* Participants attending the Arkansas Leadership Conference on Microcomputer Instruction In-service Training generally agreed that three levels of training may not meet the needs of Arkansas educators. It was recommended that Level IIB training be developed to focus on the needs of the curriculum leaders in schools i.e. principals, curriculum specialists, library media specialists and superintendents. These individuals would probably have little use for programming skills now outlined in Level II, but would need the knowledge and skill to effectively integrate computer technology into the school curriculum. A format for regional conference based on Level IIB training has been developed by the IMPAC staff. Level IIB training is essentially defined by the outline in this resource document.

Planning and Coordinating Instruction Applications
of Microcomputer Level III Training

Computer Based Instructional Consultants should be prepared to help teachers and coordinators with Level I and Level II training to use computers as management and instructional tools. Consultants should be experienced educators that can assist in the selection of appropriate computer systems for specific educational programs. Technical knowledge of software adaptation, the development of utility programs, and efficient uses of such peripherals as disks and printers represent the breadth of the consultant's knowledge. One role of the consultant is that of instructor in Level I and Level II courses. A recommended course outline is given below and assumes skills equivalent to those outlined in Level I and Level II training. Level III training, regardless of the course outline, should provide sufficient training in order for the consultant to help educators acquire knowledge of how to:

1. Integrate computers into specific content areas
2. Supervise and coordinate software collections
3. Develop software programs
4. Organize Level I courses
5. Coordinate hardware and peripheral application
6. Supervise the selection and maintenance of hardware
7. Direct or coordinate evaluations of microcomputer related instructional programs
8. Stimulate and maintain computer interests with students, teachers, administrators, parents, school board officials and the public
 - A. Identify, evaluate and recommend instructional software - 12 hours
 1. Coordination of resources and curricular objectives
 2. Identification of review sources
 3. Evaluation of software
 4. Trends in voice recognition and speech synthesis equipment
 - B. Design and develop instructional courseware - 27 hours
 1. Identification of instructional objectives
 2. Design of courseware
 3. Develop courseware with programming language or authoring system
 4. Develop accompanying support material
 5. Adaptation or modification of previously prepared courseware

- C. Utility Programs - 9 hours
 - 1. Identification of available utility programs
 - 2. Diagnostic software
 - 3. Test generators
 - 4. Graphics utilities
 - 5. Data base systems
 - 6. Remote data base systems - the sources and cost
- D. Securing and Managing software packages - 9 hours
 - 1. Acquisition policies
 - 2. Licensing and back-up
 - 3. Cataloging
 - 4. Storage
 - 5. Distribution
- E. Hardware Selection - 15 hours
 - 1. Hardware characteristics
 - 2. Computer Systems related to CAI and CMI
 - 3. Networking
 - 4. Interfacing peripherals such as floppy and hard disk, printer and modem
 - 5. Hardware maintenance through diagnostic programs
- F. Societal Issues - 6 hours
 - 1. Legal and ethical
 - 2. Social and psychological
 - 3. Economic
 - 4. Privacy of information
 - 5. Equality of access
- G. Computer Integration - 9 hours
 - 1. Appropriate content for grade level activities
 - 2. Instructional design - supplementary/unit/course
 - 3. Selection of instructional materials and software
 - 4. Evaluation of student achievement
- H. Instructional Leadership Training - 48 hours
 - 1. Procedures for conducting Level I and Level II courses
 - 2. Elementary knowledge of Basic, LOGO, PILOT and PASCAL
 - 3. Knowledge of current sources of information and research related to instructional application of microcomputers
 - 4. Procedures and techniques for dissemination of information
 - 5. Principles of instructional design and curricular integration
 - 6. Organizing Instructional Programs - laboratory versus classroom usage
 - 7. Evaluation of the major microcomputers used in education
 - 8. Mixed modes of media and computers